6.2.6.3.3 Effects from Mercury

6.2.6.3.3.1 Estimated Mercury Deposition

The NorthMet Project Proposed Action, along with other reasonable foreseeable projects have the potential for adverse effects from mercury deposition on nearby lakes, including the Heikkila, Colby, Sabin, Wynne, and Whitewater lakes, the Partridge River and Embarrass River watersheds, and the aquatic biota within these waterbodies.

The cumulative effects of mercury from the NorthMet Project Proposed Action and other cumulative actions on risks to fish consumption were analyzed using MPCA's Mercury Risk Estimation Method (MMREM). As described in Section 5.2.7.2.5, the MMREM assessed the potential changes in fish mercury concentrations in the following nearby lakes (Barr 2015f):

- Heikkila Lake;
- Colby Lake;
- Sabin Lake;
- Wynne Lake; and
- Whitewater Lake.

The five lakes are located within 12 km, about 7 miles, of the Plant Site. Heikkilla Lake, Sabin Lake, and Wynne Lake are included in the Embarrass River watershed,while Colby Lake and Whitewater Lake are closest to the Plant Site and are part of the Partridge River watershed. The closer a lake is to the Plant Site, the greater the potential for more effects from deposition related to Plant Site operations.

The MMREM method relies on empirical fish contamination data (Barr 2012b), combined with the principle of proportionality between mercury in fish and atmospheric deposition (MPCA 2006a). As other cumulative analyses have identified that local impacts from mercury deposition are small and likely not measureable in terms of fish mercury concentration within 10 kilometers of a single project, it is expected that projects located further away would have fewer impacts. Consequently, it has been determined that the maximum extent of the quantitative cumulative impact assessments using the MMREM is about 25 kilometers from the specific project of interest (Barr 2015f). The analysis considered deposition from the NorthMet Project Proposed Action and the Mesabi Nugget Large Scale Demonstration Plant emissions over existing risks. The Mesabi Nugget Large Scale Demonstration Plant was assessed because it is the only "reasonable foreseeable" project within 25 km of the NorthMet Project Proposed Action.

Because of uncertainty in speciation of emissions of the NorthMet Project Proposed Action, two speciation scenarios were used for assessing potential effects for the NorthMet Project (Barr 2015f), while only one scenario was used to evaluate the Mesabi Nugget Large Scale Demonstration Plant emissions since there was no uncertainty in the speciation of the emissions from this action. The first scenario for the NorthMet Project Proposed Action represents a conservative overestimation of oxidized mercury (25 percent elemental mercury, 50 percent oxidized mercury, and 25 percent particle bound mercury), while the second scenario is a more conservative and more likely speciation for air emissions (80 percent elemental mercury, 10

percent oxidized mercury, and 10 percent particle bound mercury) that is considered to provide a worst-case emissions scenario for the NorthMet Project Proposed Action. The scenario for the Mesabi Nugget Large Scale Demonstration plant evaluates 99.3 percent elemental mercury. (see Section 5.2.7.2.5).

The current MPCA-estimated mercury atmospheric deposition rate is 12.5 µg/m2/yr for northeast Minnesota (MPCA 2007), which translates into about 250 pounds of mercury currently being deposited onto the St. Louis River Watershed (3600 square miles) every year due to background deposition. The potential total annual deposition in the watershed from the NorthMet Project Proposed Action is estimated to be about 0.17 pounds per year (Barr 2012b), which is less than 0.1 percent of the estimated 250 pounds per year of mercury already being deposited to the St. Louis River watershed due to background deposition.

The cumulative analysis assessment showed that projected increase in mercury concentrations from the two reasonably foseeable cumulative sources in the fish for the five lakes ranges from 0.3 to 1.8 percent (when considering both scenarios), of which the increased percentage from the NorthMet Project Proposed Action alone ranges from 0.2 to 1.6 percent. Therefore, although the NorthMet Project Proposed Action alone accounts for the majority of the increase, the total added mercury to the lakes is small compared to background conditions. The highest impact in fish concentration from the NorthMet Project Proposed Action alone was at Wynne Lake where the estimated incremental increase to fish tissue mercury concentration is 0.016 ppm. This estimated incremental change in fish mercury concentration is small compared to the background fish tissue mercury concentrations in Wynne Lake range, which range from 0.35 to 2.06 ppm. The increase to fish tissue mercury concentrations at the remaining four lakes was at or below 0.012 ppm (Barr 2013c) with the background fish tissue mercury concentrations in these lakes ranging from 0.12 ppm inb Whitewater Lake to 2.06 ppm in Heikkilla Lake (Barr 2015f). These potential increases are not expected to have an appreciable effect on fish tissue mercury concentrations in the Embarrass River or Partridge River and would not have any effect on the current fish consumption advisories for the respective lakes.

6.2.6.3.3.2 Hazard Quotient

The Hazard Quotient is the ratio of the mercury concentration in fish to a health-based target of 0.2 ppm; a Hazard Quotient greater than 1 exceeds the health-based target. To estimate the potential incremental Hazard Quotient, the incremental methyl mercury exposure in mg/kg body weight per day and the reference dose are accounted for in the calculation. The incremental Hazard Quotient calculation in the MMREM Spreadsheet uses the following methodology:

- Incremental daily mercury consumed (mg) = estimated incremental increase in fish mercury due to the Project (mg/kg) x the amount of fish consumed (e.g. 0.142 kg for a subsistence fisher);
- Incremental methylmercury exposure (mg/kg body weight per day) = Incremental daily mercury consumed x 1.07945 / adult body weight (70 kg); and then
- Incremental Hazard Quotient = incremental methylmercury exposure (mg/kg body weight per day) / Reference Dose of 1.00E-04 mg methyl mercury/kg body weight per day (i.e., the ratio of the incremental methylmercury exposure divided by the reference dose in the same units).

The maximum incremental cumulative Hazard Quotient from the two reasonably foreseeable cumulative projects over existing fish mercury concentrations is 0.08 for recreational anglers, 0.61 for subsistence/tribal anglers, and 0.54 for subsistence fishers. This is only about a 0.3 to 1.8 percent increase over the existing incremental risk levels, for recreational, subsistence/tribal and subsistence anglers. Of this, the NorthMet Project Proposed Action contributes approximately 59 to 92 percent of the incremental cumulative Hazard Quotient. Note that the current fish tissue concentration in the five lakes results in Hazard Quotients that exceed 1, leading to the need for the fish consumption advisories currently in effect (see Table 6.2.6-1).

Table 6.2.6-1 Analysis of Existing Hazard Quotient (HQ) of Cumulative Impacts Mercury Deposition for Five Lakes following Three Fish Consumption Scenarios

Lake	MDNR #	Speciation Scenario	Recreational Angler[1]		Subsistence/Tribal Angler[2]		Subsistence Fisher[3]	
			Existing HQ	Incremental Cumulative HQ	Existing HQ	Incremental Cumulative HQ	Existing HQ	Incremental Cumulative HQ
Colby Lake	69024900	Scenario 1	4.3	0.05	32	0.4	28.4	0.35
		Scenario 2		0.02		0.1		0.10
Heikkilla Lake	69025300	Scenario 1	3	0.05	22.3	0.4	19.8	0.35
		Scenario 2		0.01		0.1		0.09
Sabin Lake	69043401	Scenario 1	4.7	0.06	35.1	0.5	31.2	0.41
		Scenario 2		0.02		0.1		0.11
Whitewater Lake	69037600	Scenario 1	1.6	0.01	11.9	0.1	10.6	0.09
		Scenario 2		0.01		0.0		0.03
Wynne Lake	69043402	Scenario 1	6.2	0.08	46.2	0.6	41	0.54
		Scenario 2		0.02		0.2		0.15

Source: Barr 2012b

[1] Consumption rate assumed to be 30 grams/ day.
[2] Consumption rate assumed to be 224 grams/ day and approximates the allowed take of fish by a Tribal member (~ 180 pounds per year of fish).
[3] Consumption rate assumed to be 199 grams/day.

6.2.6.3.3.3 Water Mercury Mass Balance

In addition to atmospheric mercury deposition, water discharges from the NorthMet Project area would affect the mercury load in the Embarrass and Partridge rivers (and ultimately on downstream portions of the St. Louis River). As discussed in Section 5.2.2.3.4, a water mass balance was performed to assess mercury load from NorthMet Project Proposed Action. The mass balance indicated that overall, the NorthMet Project Proposed Action is predicted to result in a net decrease in mercury loading to the St. Louis River watershed and are not likely to result in an appreciable change in the mercury concentration in fish in water bodies of the St. Louis River watershed, including the Embarrass River or Partridge River, or in the St. Louis River itself (Barr 2015f). Potential mercury increases from air deposition discussed above would not be expected to have any appreciable effect on inputs into the water quality mass loading calculations.

6.2.6.3.3.4 Statewide Mercury TMDL and Mitigation Measures

The MPCA Statewide Mercury TMDL is intended to provide the long-term framework to reduce mercury in fish within Minnesota lakes, including the five lakes targeted in this assessment. The MPCA and industries emitting mercury into the atmosphere are working to reduce Minnesota sources' contribution to fish contamination. Minnesota is relying on actions by other states and the USEPA to address deposition from long-range sources.

In the period of time between completion of the cumulative effects analysis background study for Minnesota Steel and the development of this FEIS, Minnesota stakeholders created an implementation plan for Minnesota's mercury TMDL (MPCA 2009). Within the implementation plan, there is a process for assessing new and expanding sources of mercury in Minnesota. It is important to assess sources so that while existing sources reduce emissions, new sources do not interfere or confound the state's progress in reducing mercury emissions overall. At the recommendation of the Minnesota stakeholders, MPCA has developed guidance for new and modified sources of mercury in Minnesota (MPCA 2013d). The guidance requires sources to: employ best controls to reduce mercury emissions and apply emissions limits to permit conditions. MPCA has conducted a review of the NorthMet Project Proposed Action mercury emissions and has determined that it would not impede the reduction goals (MPCA 2013c). Thus, no minimization and mitigation plan would be required for the NorthMet Project Proposed Action (see Section 5.2.7.2.5). Mercury mitigation measures are summarized in Section 5.2.2.3.5 (water) and in Section 5.2.7.4 (air).